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### Recovery from mild traumatic brain injury

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# Chapter 4

Stability of coping and the role of self-efficacy in the first year following mild Traumatic Brain Injury

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## Abstract

**Background and aims:** Coping, the psychological adaptation to stressors and serious life events, has been found to have a great influence on the development and persistence of posttraumatic complaints. Coping has received much attention for having been found to be modifiable in treatment following mild traumatic brain injury (mTBI) and for its potential to identify the Patients who are at risk of suffering from long-term complaints. Currently, coping styles are assumed to be stable over time. Although interventions to facilitate adaptive coping are given at different time intervals after the injury, little is known about spontaneous changes in preferred strategies over time following mTBI. This study aimed to investigate the stability of different coping styles over a one-year period following mTBI (at two weeks', six and twelve months' post-injury) and to investigate the relation between coping styles and feelings of self-efficacy.

**Methods:** We included 425 mTBI patients (Glasgow Coma Scale [GCS] score 13-15) admitted to three Level-1 trauma centers in the Netherlands as part of a prospective follow-up study. All participants filled out The Utrecht Coping List (UCL) to determine their position on seven coping subscales.

**Results:** Most coping styles showed a decrease over time, with the exception of positive reframing, which showed a decrease and a consecutive increase. Interestingly, the passive coping style was found to stabilize over time within the year after injury. High feelings of self-efficacy were related to a high active coping style ( $r=.36$ ), and low feelings of self-efficacy with passive coping ( $r=-.32$ ).

**Conclusions:** These results hold important possibilities for the use of the passive coping strategy as an inclusion criterion for intervention studies and an entry point for treatment itself. Considering the intertwinement of coping with self-efficacy, improving feelings of self-efficacy could form an effective part of an intervention to improve outcome.

## Introduction

More than 80% of all traumatic brain injuries (TBI) can be considered as mild, making mild traumatic brain injury (mTBI) one of the most common neurological disorders in the world (Baratz, Rubovitch, Frenk, & Pick, 2010). Although most mTBI patients show a full recovery within a few weeks, a minority (15-25%) of patients reports persistent somatic, cognitive, and emotional posttraumatic complaints that interfere with resumption of work and other activities (Ponsford et al., 2012). Many studies have aimed to investigate which factors determine individual differences in recovery trajectories, and much attention has been paid to the concept of coping, which describes the various ways individuals can psychologically adapt to serious life events such as mTBI (Maestas et al., 2014). Inadequate coping styles have been found to be of great influence on the development and persistence of complaints (Miller & Mittenberg, 1998; Snell, Hay-Smith, Surgenor, & Siegert, 2013), and have therefore often been used as a target of cognitive behavioral interventions (Folkman & Moskowitz, 2004; Miller & Mittenberg, 1998; Snell et al., 2013). Currently, coping style is often measured at one time point early after injury as an indication of pre-injury coping, and is related to outcomes for up to several years after the injury, assuming that one's coping style is stable over long periods of time (Geyer, Koch-Giesselmann, & Noeres, 2015). Although interventions and treatments aimed at improving coping style are offered to patients at varying times after the injury (Al Sayegh, Sandford, & Carson, 2010), little is known about spontaneous changes in preferred strategies over the time of recovery following mTBI.

Coping is a very broad concept and has a long history with many different theoretical orientations that can be approached from different perspectives (Eisenbarth, 2012). However, there is consensus in coping being an organizing construct that can be used to describe all the efforts a person makes to prevent or diminish stressful experiences (Carver & Connor-Smith, 2010a; Eisenbarth, 2012). The most commonly used definition of coping is that of Lazarus and Folkman (1984), who defined coping as the cognitive and behavioral efforts to manage the internal and external demands of situations that are appraised as stressful. Coping strategies are thought to be orthogonal constructs, in which individuals are prone to use one coping strategy over another (Eisenbarth, 2012; Nielsen & Knardahl, 2014). A commonly used distinction in coping strategies is the classification of strategies into two subtypes: active, problem-focused coping and emotion-focused coping that attempts to diminish discomfort by altering appraisal of the stressor. Another commonly used distinction is between engagement and disengagement coping (Nielsen & Knardahl, 2014). Engagement coping, otherwise known as approach coping, is aimed at dealing with the stressor or related emotions and includes both problem-focused and emotion-focused coping strategies (e.g., seeking social support, cognitive restructuring). Disengagement coping entails a more avoidant response style, and is often emotion-focused (avoidance, denial, wishful thinking) (Carver & Connor-Smith, 2010a). Passive coping styles are based on denial or avoidance of problems and focusing on negative feelings rather than actively solving the problem. Although the effectiveness of a certain coping style strongly depends on the situation, a passive coping style is generally associated with a negative outcome following mTBI (Curran, Ponsford, & Crowe, 2000; Gould, Ponsford, Johnston, & Schonberger, 2011; Gregorio, Gould, Spitz, van Heugten, & Ponsford, 2014a; Linley & Joseph, 2004). Coping style is partly dependent on an individual's beliefs of self-efficacy, which can be defined as trust in one's capability to

deal with adverse situations such as a trauma (Bonanno, Brewin, Kaniasty, & Greca, 2010). In patients with chronic disease, a high level of general self-efficacy was related to the use of more adaptive coping strategies (i.e., strategies that actually decrease the perceived stress) and lower levels of anxiety and depression in contrast with patients with low general self-efficacy (Luszczynska, Scholz, & Schwarzer, 2005).

Studies in different patient populations show that, although coping style is thought to be a relatively stable trait, the choice of a particular coping strategy can be highly dependent on the situation and the specific phase in the recovery process. For example, two recent studies on coping in patients with osteoarthritis (Regier & Parmelee, 2015) and breast cancer (Geyer et al., 2015) reported change in all coping styles over two- and ten-year periods, respectively. Changes in coping style also appeared in studies on TBI of mixed severity, in which a decrease in active, problem-focused strategies in combination with an increase in emotion-focused coping strategies are most often reported (Dawson, Cantanzaro, Firesstone, Schwartz, & Stuss, 2006; Kendall, Shum, Lack, Bull, & Fee, 2001; Tomberg, Toomela, Ennok, & Tikk, 2007). There is still a need to investigate the mTBI population separately, considering that cognitive disorders caused by severe TBI might cause changes in coping strategies that cannot be compared to mTBI patients (Moore & Stambrook, 1995). Studies on long-term changes in coping following mTBI are sparse. We are aware of one study that investigated changes in coping style following mTBI and reported no changes over time (Snell et al., 2013); yet, it only measured at two time points to a maximum of six months after injury. Considering the importance of coping style for outcome after mTBI and the implications for treatment interventions, looking more elaborately into the stability and/or spontaneous changes in coping styles following mTBI is very important, which might aid in a more precise identification of patients at risk of an unfavorable outcome and promote a tailored treatment.

The main goal of this study was to investigate the stability of coping styles over a one-year period following mTBI and investigate the relation of coping styles with feelings of self-efficacy. Based on several studies in TBI and other patient populations that all showed changes over time in coping styles, we expected that this would also be the case in our mTBI population. The prediction of exact patterns over time was difficult due to the lack of literature on mTBI specifically. That said, when looking at the patterns found in most studies on coping in TBI, we expected passive coping styles to increase and active coping styles to decrease over time. Furthermore, we expected that patients with an active problem-focused coping style to have higher levels of self-efficacy and that those with a passive coping style would have lower levels of self-efficacy. Given the chronic nature of posttraumatic complaints, the development of a more adaptive coping style could be a crucial determinant of improving recovery following mTBI. Insight regarding changes over time of coping styles following mTBI might be essential for develop a tailored and effective intervention.

## Methods

### Design and Setting

This study is part of a larger ongoing prospective cohort study on outcome in mTBI (the UPFRONT-study). The study was approved by the Ethics committee of the University Medical Center Groningen, and began in January 2013. Patients were included in three level I trauma centers; University Medical Center Groningen (UMCG), St. Elisabeth Hospital Tilburg (EZH) and the Medisch Spectrum Twente (MST) in the Netherlands. Patients included in this study received questionnaires two weeks, six months and twelve months after injury. Demographic variables and injury characteristics were obtained from the hospital records. The Injury Severity Score (ISS) was determined based on these records (Baker, O'Neill, Haddon, & Long, 1974).

### Participants

The sample consisted of patients 16 years and older with mTBIs who were admitted to the emergency departments of the UMCG, MST and EZH between January 2013 and December 2015. The mTBI was defined according to the recommended guidelines of the EFNS task force (European Federation of Neurological Societies): a blunt impact to the head with sudden acceleration, deceleration or rotation resulting in: a Glasgow Coma Scale (GCS: (Teasdale & Jennett, 1974) score of 13-15 on presentation at the emergency department, posttraumatic amnesia of less than 24 hours and/or loss of consciousness lasting less than 30 minutes (Vos et al., 2012). Exclusion criteria were: chronic alcohol and/or drug abuse and major psychiatric and neurological disorders. Patients with no permanent home address or insufficient comprehension of the Dutch language were also excluded due to anticipated follow-up difficulties. Educational level was determined by use of the Dutch Verhage scale (Verhage, 1964), ranging from 1 (no primary school) to 7 (university).

### Measures

**Coping style.** Coping was measured at two-weeks, six- and twelve-months post-injury, by means of The Utrecht Coping List (UCL: (Schreurs, Tellegen, & Willige, 1984) The UCL is a questionnaire that assesses coping styles with 47 items that ask for the way a person acts to minimize the impact of stressful events. The items have a 4-point scale score, with 1=seldom or never, 2=sometimes, 3=often, 4=very often. The UCL has 7 subscales that represent different coping styles: active, distraction-seeking, avoidance, seeking social support, passive, expression of emotions and positive reframing. Scores on each subscale were summed to create a total score for each subscale, which were used for the repeated measures analyses. These sum scores were also compared to an age- and gender matched norm group, determining a range from a very low use of that coping style to very high use compared to an age- and gender matched norm group (range 1-5). For analysis, we dichotomized the values in a high (range 4-5) versus not high use of the coping style (1-3).

**Self-efficacy.** The Dutch version of the General Self-efficacy Scale (DGSES: Schwarzer & Jerusalem, 1995) was used to assess a general sense of perceived self-efficacy in dealing with daily troubles as well as adaptation after stressful life events such as sustaining a mTBI. The DGSES was measured two weeks and six months after injury. Self-efficacy has been conceptualized as an important component of resilience, which

is the ability to cope adaptively with traumatic stressors (Schwarzer & Warner, 2013). The DGSes consists of 10 items with a 4-point scale from 1=entirely false to 4=completely true. Responses are summed up to a total score that can range from 10-40.

**Posttraumatic complaints.** The Head Injury Symptom Checklist (HISC: de Koning et al., 2016) describes 21 complaints commonly reported after TBI, where patients can indicate a pre-injury and a current symptom level. Values range from 0 to 2 (0 = never, 1 = sometimes, 2 = often). The HISC was measured at two weeks after injury, of which we used the total number of complaints (adding up from 0 – 21).

**Depression and anxiety.** The presence or absence of depression and/ or anxiety was assessed by means of the Hospital Anxiety and Depression Scale (HADS: Zigmond & Snaith, 1983) The HADS is a 14-item questionnaire with two subscales, the depression scale (HADS-D) and anxiety scale (HADS-A) of seven items each. Items are rated on a scale from 0-3. Our analyses use the recommended cut-off score of  $\geq 8$  for establishing the presence of both depression and anxiety (Bjelland, Dahl, Haug, & Neckelmann, 2002).

**Functional outcome.** The Extended version of the Glasgow Outcome Scale (GOSE: Wilson, Pettigrew, & Teasdale, 1998) is a structured interview that patients may also fill out at home. It provides 8 categories of outcome ranging from 1 indicating “death”, to 8 indicating an “upper good recovery” (Levin et al., 2001). A GOSE score 8 indicates a return to fully functioning status at daily activities and work without any disabilities. For analyses, scores were dichotomized in a favorable outcome (GOSE score=8) versus an unfavorable outcome (GOSE score <8).

### Statistical Analysis

Data were analyzed with SPSS 22.0 (IBM Corp, 2013). Differences in demographics and injury related characteristics between the included group (with complete coping questionnaires on all time measurements) and the excluded group (incomplete questionnaires) were tested using the  $\chi^2$  test (categorical data) and two sample Student’s t-test (parametric data). Where appropriate, other non-parametric tests were used. These tests were also utilized for the comparison of the favorable group and the unfavorable group. To investigate changes in coping style over time, a repeated measures ANOVA was used on raw scores per subscale. When the assumption of sphericity was violated, the Greenhouse and Geisser (1959) column was used to correct the one-way repeated measures ANOVA. Spearman’s rank correlations were used to examine the relation between self-efficacy and coping styles. Post-hoc mean comparisons were performed using univariate tests under the Bonferroni criterion. The value for  $\alpha$  was set at 0.05, two-sided.

## Results

### Population

Figure 1 shows a flowchart of included patients at each time interval with the percentage of drop-out. Of the 733 patients who completed the questionnaire at two weeks, 425 patients completed the coping questionnaire on all consecutive time measurements. These 425 patients were included for further analyses.

**Figure 1. Flowchart included patients on each time interval with percentage of drop-out (full drop-out of study or missing a time measurement)**

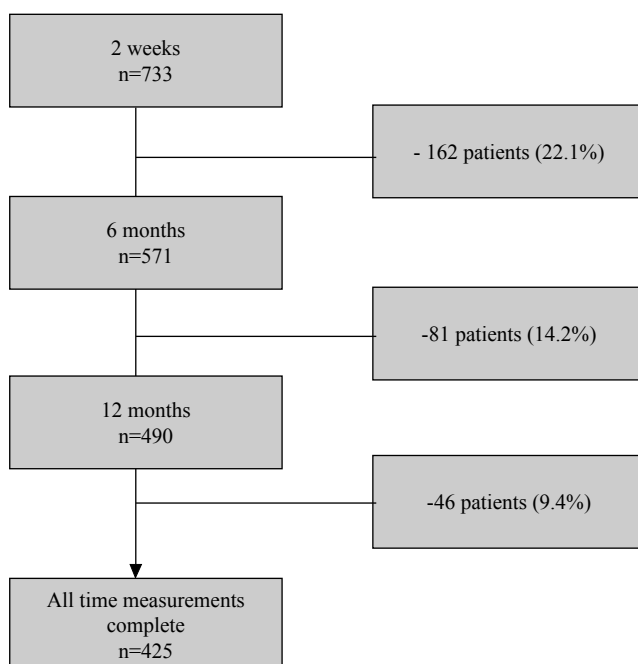


Table 1 shows the demographics and injury characteristics of the included patient group compared with the 308 mTBI Patients who did not fill out all their coping questionnaires. Patients who filled out all the questionnaires were less often male (60% vs. 68%) and were significantly older than the group that did not (51 vs. 41 years on average). Patients who did fill out the questionnaires also had a higher educational level (Dutch Verhage scale (Verhage, 1964); mean 5.1 vs. 4.8). Regarding mechanism of injury, the included group had significantly more patients with bike accidents (36% vs 27%) and less violence related injuries (2% vs. 10%). In relation to injury-related characteristics, the included group had a higher ISS score (7.7 vs 7.3) and a higher percentage of CT-abnormalities (18% vs 14%). The included group was less likely to have had pre-injury mental health problems for which they needed treatment (9% vs. 14%). No significant differences were found in terms of GCS score, hospital admission and number of posttraumatic complaints two weeks' post-injury.



**Table 1. Characteristics of the study population**

Variable	1) Included patients	2) Not included (incomplete)	Difference 1 vs. 2	
	(n=425)	(n=308)	statistic (df)	p
Patient demographics				
Male gender	253 (59.5)	218 (67.9)	$\chi^2 = 5.5 (1)$	.021
Age	51.1 (18.2) 16-92	41.1 (19.4) 16-92	$t = -7.2 (744)$	<.001
Education	5.1 (1.3) 2-7	4.8 (1.4) 2-7	$U = 56811$	.005
Mechanism of injury				
Traffic				
-Motor vehicle accident	61 (14.4)	55 (17.9)	$\chi^2 = 1.1 (1)$	.308
-Bike accident	153 (36)	85 (27.6)	$\chi^2 = 7.5 (1)$	.007
-Pedestrian	14 (3.3)	8 (2.6)	$\chi^2 = 0.42 (1)$	.526
Falls	160 (37.6)	114 (37)	$\chi^2 = 0.33 (1)$	.591
Violence	7 (1.6)	30 (9.7)	$\chi^2 = 22.9 (1)$	<.001
Sports	10 (2.4)	5 (1.6)	$\chi^2 = 0.58 (1)$	.600
Other	14 (3.3)	19 (6.2)	$\chi^2 = 2.9 (1)$	.105
Injury characteristics				
GCS score	14.5 (0.65) 13-15	14.6 (.62) 13-15	$U = 64647$	.146
Hospital admission (yes)	268 (67.3)	190 (61.7)	$\chi^2 = 1.2 (1)$	.289
ISS (injury severity) <sup>b</sup>	7.7 (5.6) 0-39	7.3 (4.6) 0-29	$t = -2.6 (734)$	.009
CT abnormalities				
Pre-injury psychological treatment				
	38 (8.9)	44 (14.3)	$\chi^2 = 15.2 (1)$	.005
HISC (complaints) <sup>c</sup>	5.1 (4.2) 0-18	5 (4.2) 0-18	$t = -0.31 (744)$	.756

Mean ( $\pm$ SD), range; all others=number (%). GCS=Glasgow Coma Scale; ISS=Injury Severity Scale; HISC=Head Injury Symptom Checklist

a Pearson's chi-square test, Independent t-test, Mann Whitney U test

b High scores on ISS represent a more severe injury

c High scores on HISC represent more self-reported posttraumatic complaints

## Outcome

Of the included 425 patients an outcome score was available for 409 patients at twelve months (96%). Table 2 shows a comparison of the favorable outcome group versus (60%) unfavorable outcome group (40%) on demographic measures and psychological measures. Results show that the favorable outcome group consisted of more males, were younger and had lower numbers of patients with a high use of passive coping and positive reframing, and had fewer patients who had clinical levels of depression and anxiety.

**Table 2. Comparison of favorable versus unfavorable outcome groups on demographics and psychological measures<sup>a</sup>**

Variable	1) Favorable outcome	2) Not included (incomplete)	Difference 1 vs. 2	
12 months	2) Unfavorable outcome	(n=308)	statistic (df)	p
Patient demographics				
Male gender	162 (66.4)	81 (49.1)	$\chi^2 = 12.2 (1)$	.001
Age (years)	49.6 (18.6)	53.8 (17.2)	$t=2.34 (407)$	.020
Age range (years)	16, 92	17, 91	—	
Education	5.2 (1.2) 2-7	4.9 (1.4) 2-7	$U=22527$	.082
Coping style <sup>b</sup>				
Active coping	73 (30.3)	41 (24.8)	$\chi^2 = 1.3 (1)$	.262
Distraction seeking	77 (32.1)	55 (33.7)	$\chi^2 = 0.12 (1)$	.746
Avoidance	90 (37.2)	50 (30.5)	$\chi^2 = 1.9 (1)$	.169
Seeking social support	80 (32.8)	49 (29.7)	$\chi^2 = 0.44 (1)$	.518
Passive coping	46 (18.9)	55 (33.7)	$\chi^2 = 11.45 (1)$	<.001
Expression of emotions	43 (17.6)	28 (17)	$\chi^2 = 0.03 (1)$	.895
Positive reframing	60 (24.7)	56 (33.9)	$\chi^2 = 4.1 (1)$	.045
HADS <sup>c</sup>				
Depression	17 (7.1)	44 (27)	$\chi^2 = 29.6 (1)$	<.001
Anxiety	22 (9.2)	38 (23.3)	$\chi^2 = 15.1 (1)$	<.001

Mean ( $\pm$ SD), range; all others=number (%). HADS=Hospital Anxiety and Depression Scale

<sup>a</sup> Pearson's chi-square tests, Independent t-test and Mann Whitney U test

<sup>b</sup> Patients scoring high to very high on use of individual coping styles.

<sup>c</sup> Patients scoring above cut-off on HADS-D and HADS

### Coping Styles Over Time

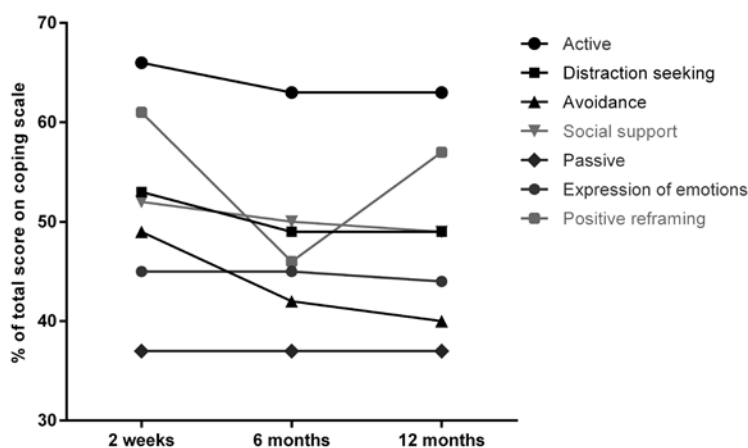
The results of the repeated measures ANOVA of the seven different coping styles showed significant differences over time for scores on all coping styles except passive coping and expression of emotions. The passive coping style remained stable over time ( $F(1.9, 716.74) = .211, p = .804$ ), with mean scores of 10.5, 10.4, and 10.4 on the two weeks', six and twelve months' measurement, respectively. Expression of emotions also did not change over time ( $M = 5.4, M = 5.4$  And  $M = 5.3$ ),  $F(2.77, 766.98) = 1.3, p = .68$ . Because the individual subscales have varying maximum scores, Figure 2 represents the percentage of the maximum score that was scored on each of the different coping styles on the three time points for the included group of Patients who completed all three questionnaires.

The use of an active coping strategy significantly decreased over the different time points ( $F(1.87, 698.28) = 10.63, p < .001$ ) with mean scores decreasing from 18.5 at two weeks, to 17.8 at six and twelve months. Post hoc analysis revealed that this coping style was significantly reduced from two weeks to six months (0.65 (95% CI = 0.19 to 1.1,  $p = .002$ ) and two-weeks' to twelve-months' post-injury (0.71, 95% CI = 0.30 to 1.1,  $p < .001$ ). The use of distraction seeking also decreased significantly over time ( $F(2, 746) = 34.78, p < .001$ ) with mean scores decreasing from 17 at two weeks to 15.8 at six and twelve months. Distraction seeking was used in a lower degree from two weeks to six months (1.14, 95% CI = 0.74 to 1.54,  $p < .001$ ) and twelve months (1.22, 95% CI = 0.81 to 1.62,  $p < .001$ ). Both the use of avoidance and seeking social support decreased significantly over time ( $F(1.95, 711.61) = 221.40, p < .001, M = 15.9, M = 13.6, M = 13.2$ ;  $F(1.95, 757.96) = 22.64, p < .001, M = 12.7, M = 12, M = 11.9$ ). Post hoc analyses showed that avoidant scores were significantly lower on each subsequent time point (two weeks to six and twelve months: 2.33, 95% CI = 1.98 to 2.68,  $p < .001$ ; 2.80, 95% CI = 2.44 to 3.16,  $p < .001$ , and six months to twelve months: 0.47, 95% CI = 0.15 to 0.78,  $p = .001$ ). In terms of seeking social support, the significant differences were found between two weeks and six (0.71, 95% CI = 0.37 to 1.04,  $p < .001$ ) and two weeks and twelve months (0.82, 95% CI = 0.50 to 1.14,  $p < .001$ ). The use of positive reframing changed also significantly over time ( $F(1.89, 742.56) = 347.28, p < .001$ ), but with a different pattern than the aforementioned coping styles (mean scores 12.3 at two weeks, 9.3 at six months and 11.5 at twelve months). There was a significant decrease from two weeks to six months (3.0, 95% CI = 2.74 to 3.27,  $p < .001$ ), followed by a significant increase from six to twelve months (-2.18, 95% CI = -2.45 to -1.92,  $p < .001$ ). There was also a significant difference in scores from two weeks to twelve months, in which patients scored lower at twelve months (0.82, 95% CI = 0.51 to 1.14,  $p < .001$ ).

### Self-efficacy Over Time

The average scores on self-efficacy at six months' post-injury are slightly higher than two weeks' post injury (31.4 vs. 31.7,  $p = .004$ ). Although significant, this does not seem to reflect a clinically relevant difference. The mean scores on self-efficacy are average to above average when compared to an empirical distribution of international dataset with 18.000 respondents ( $M = 29$ ) (Schophaus & Wolf, 2000).

Figure 1: Coping styles over time (n=444)



### Coping and Self-efficacy

Table 3 shows the correlations between scores of the different coping styles at two weeks with self-efficacy scores at two weeks, and of both measures at six months. Significant correlations were found between self-efficacy and the use of an active, avoidant and a passive coping style respectively, on both time measurements. Only the use of an active coping style was positively related to a higher score on self-efficacy, with moderate positive correlations found ( $r=.36$  and  $r=.27$  respectively). All other significant correlations were negative, with moderate negative correlations being found between passive coping style and self-efficacy ( $r=-.32$  and  $r=-.31$ ), and a weak correlation between avoidant coping style and self-efficacy ( $r=-.20$  and  $r=-.18$ ). Hence, a high use of a passive- and avoidant coping style was related to a lower feeling of self-efficacy.

A linear regression analysis was run to understand the influence of early reported coping styles (two weeks' post-injury) on self-efficacy scores six months after injury. Reported coping styles at two weeks significantly predicted self-efficacy scores at six months  $F(7,407)=15.37$ ,  $P<.001$ , accounting for 21% ( $R^2$ ) of the explained variability. It was found that the active coping style ( $\beta=.47$ ,  $p<.001$ , 95% CI = .33 to .61) and the passive coping style ( $\beta= -.63$ ,  $p<.001$ , 95% CI = -.82 to -.43) were significant predictors. Distraction seeking, avoidance, seeking social support, expression of emotions and positive reframing were not significant predictors.

**Table 3. Correlations between Self-efficacy scores and Coping Style scores.**

<b>Coping Style</b>	<b>Self-efficacy</b>	
	<b>week 2</b>	<b>6 months</b>
Active	.36**	.27**
Distraction Seeking	-.13	-.10
Avoidant	-.20**	-.18**
Seeking social Support	-.02	-.02
Passive	-.32**	-.31**
Expression of emotions	-.14	-.11
Positive reframing	.02	.06

Note. Correlations use the Spearman formula.

\*\*  $p < .01$  level after Bonferroni-Holm correction

## Discussion

The present study aimed to assess the stability of coping styles following mTBIs over a one-year period, and to determine associations between different coping strategies and feelings of self-efficacy. This study is one of the few that examined the stability of coping styles over time in a mTBI population. Our results demonstrated that only two coping styles showed no change over time: the passive coping style and expression of emotions were stable throughout the first year after injury. Most other coping styles of mTBI patients however, showed a steady decrease over time, with the exception being positive reframing, which showed an initial decrease and consecutive increase. Regarding self-efficacy, the current study found interesting associations between coping style and feelings of self-efficacy in which high feelings of self-efficacy were related to an active coping style, and low feelings of self-efficacy to a passive/avoidant coping style.

Differences over time were found in the use of active coping, distraction seeking, avoidance, seeking social support and positive reframing. There was a decrease in the use of these strategies from two weeks to twelve months, in which all but one show a steady decline. The exception was positive reframing, which showed a decline from two weeks to six months and an increase from six to twelve months. With regard this varying pattern of positive reframing, studies show that the use of this strategy is very dependent on feelings of optimism and expectation of a good outcome, which can differ greatly per situation and thus over time (Carver & Connor-Smith, 2010a). The steady decline in the use of most coping strategies has been reported before in a previous study by Wolters and colleagues in patients with a severe TBI (Gregorio et al., 2014a). They explained it by lack of insight shortly after injury, but considering the less severe nature of mTBI, it is more plausible that the decrease found in the current study is directly related to the encountered events in the recovery period. Since coping questionnaires ask patients how often they use a certain strategy, it is likely that in the period shortly after the injury, patients encounter more stressful situations that will make their use of coping strategies more salient to them. With the majority of patients recovering within months (Ponsford et al., 2012), these high levels of injury-related stress and thus the need for and reporting of coping strategies fades away over time (King, 2008). Clinicians should know that the measures of these coping styles of patients shortly after trauma might represent a magnified version of their usual coping profile. However, it remains difficult to draw hard conclusions for the time being, given that the changes mentioned above were relatively modest, and these coping styles are not usually considered targets of interventions.

The passive coping style could be a very valuable target for interventions, having been most robustly linked to higher levels of stress and anxiety and an adverse outcome in mTBI patients (also in this current study) but also many other patient populations (Curran et al., 2000; Gould et al., 2011; Gregorio et al., 2014a; Linley & Joseph, 2004). Our finding that a passive coping style is stable over time may hold important clinical implications. It means that patients at risk of suffering from an adverse outcome can be identified by means of a high use of this strategy in an early phase, and targeted for intervention. This stability might also indicate that without an intervention, a high use of passive coping style will persist. Although different from previous studies, which found maladaptive styles to increase over time in TBI patients (Gregorio, Gould, Spitz, van Heugten, & Ponsford, 2014b; Tomberg et al., 2007; Wolters, Stapert, Brands, & Van Heugten, 2010), our finding that the passive

coping style is rather stable over time illustrates the long-standing ‘personality versus situation’, and ‘state versus trait’ debate (Heim, Augustiny, Schaffner, & Valach, 1993). On the one hand, dispositional stabilities may exist, and on the other hand, the requirements of a specific situation can affect the choice of coping style (Taylor & Stanton, 2007). With regard to passive coping, the personality trait of neuroticism has been repeatedly and rather strongly associated with the passive coping style, meaning that it is less susceptible to environmental circumstances than coping styles less related to personality traits (Carver & Connor-Smith, 2010b; DeLongis & Holtzman, 2005). Although of less clinical importance, the fact that this study found expression of emotions to be stable over time underpins this explanation. Like the passive coping style, expression of emotions has also been found to be positively related to neuroticism (Carver & Connor-Smith, 2010a).

Self-efficacy, or an optimistic belief of being able to control and alter one’s environment, has been suggested to be a prerequisite for using an adaptive coping style (Taylor & Stanton, 2007), and has been identified as a valuable potential intervention target. In the current study, it was found that higher feelings of self-efficacy were associated with a more active coping style, and that lower levels of self-efficacy were associated with a more passive and to a lesser extent, avoidant coping style. Moreover, early passive coping and active coping were significant predictors of self-efficacy levels at six months, which is in line with studies that investigated the relation between self-efficacy and coping in other patient populations (e.g., gastrointestinal disease, cancer, rheumatoid arthritis) (Brown & Nicassio, 1987; Luszczynska et al., 2005). These studies consistently found that patients high in general self-efficacy exhibited more active and less passive coping strategies. These findings are easily explained by the belief that people have in their ability to cope, determines the level of stress they experience facing difficult or stressful situations, and their motivation to act upon this situation (Bandura, 1994). People with high feelings of self-efficacy have more trust in their own abilities, tend to view problems as challenges rather than threats and have a higher likelihood of motivating themselves and show perseverance when dealing with difficult situations. People with low feelings of self-efficacy on the other hand, have a higher tendency to view problems as threats and to not have faith in their own abilities to act in difficult situations, which causes them to be weakly committed to their goals and give up quickly (Schwarzer & Warner, 2013).

Most interestingly, it was found that a passive coping style was stable over a one-year time period. This means that it could be a valuable and reliable indicator of long term problems at any interval between the measurement and time since the injury. Moreover, it may not change spontaneously and could thus be a target for treatment, given its strong relation with a negative outcome (Miller & Mittenberg, 1998; Snell et al., 2013). Clinicians aiming to prevent persistent complaints could therefore use this knowledge at a very early stage to identify the patients with a high use of passive coping who are at risk of suffering from long-term complaints. Also, a high use of a passive coping style is highly likely to be accompanied by low feelings of self-efficacy, which may be another valuable target for an effective intervention. Since the belief in one’s own coping abilities is a prerequisite for motivation to act (Bandura, 1994), these interventions could be focused on improving feelings of self-efficacy, thereby decreasing passive coping and replacing them with more adaptive coping skills.

### Limitations

Some limitations of this study need to be addressed. First, we did not have any information on subsequent life events in the period after sustaining the mTBI. Future research should consider other challenging life events besides dealing with the consequences of mTBI that appeal to adaptive resources, such as coping style. Second, similar to most longitudinal mTBI studies, the generalizability of our findings is limited by some patients discontinuing enrollment. The group of excluded patients who did not complete all questionnaires were more likely younger men and had a lower educational level. Research shows that patients who are lost to follow-up are more likely to have a good outcome, potentially leading to a bias towards worse outcome (Corrigan et al., 2003). Another factor influencing generalizability concerns the recruitment bias at the emergency department. Besides the fact that some patients at the emergency department are unwilling to participate, part of the mTBI population does not present at the emergency department, or does so instead to their general practitioner (Faul, Xu, Wald, & Coronado, 2010; Scholten, Haagsma, Panneman, van Beeck, & Polinder, 2014). Although these are common problems in studies on mTBI (Langley, Johnson, Slatyer, Skilbeck, & Thomas, 2010), it might have resulted in our study population not accurately representing the average mTBI population. Another important consideration is that this study relies on a self-report inventory to determine coping style. For example, Kendall and colleagues advocate for a contextually valid semi-qualitative technique for the assessment of coping (Kendall et al., 2001). In self-report measuring, the link between stated and actual behavior is not always unequivocal (e.g., socially appropriate responses), which could have led to a less accurate representation of the actual coping styles.

### Conclusions

In summary, the current study found that most coping styles after sustaining a mTBI were variable over time, except for passive coping and expression of emotions. Especially the stability of passive coping holds important possibilities for the use of this coping strategy as way of identifying patients for intervention studies and as an entry point for the treatment itself. When considering the sequential intertwinement with coping, enhancing feelings of self-efficacy could form an effective part of an intervention aimed at improving outcomes.



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